THE PATHOLOGICAL REPORT OF A CASE OF ŒSOPHAGOSTOMIASIS IN MAN

BY

H. WOLFERSTAN THOMAS, M.D., C.M. (McGILL),

Of the Research Laboratory in Manáos, State of Amazonas, North Brazil,

AND THE

Thompson-Yates and Johnston Laboratories, University of Liverpool.

Expedition to the Amazon, 1905-1909.

(Plates I, II, III, IV, V, V^{A}, V^{B})

Œsophagostomiasis is a disease produced by a small nematode, an œsophagostome, of which there are several species. The larvae of this worm become encysted in the coats of the bowel, usually in the large intestine, and gradually develop into immature adult œsophagostomes. They can rupture their cyst walls and pass into the lumen of the intestine or into the peritoneal cavity.

Anthropoid apes, certain species of monkeys, and some of the domestic animals can be infected by various œsophagostomes. In a monkey it is not at all uncommon to find small subperitoneal nodules and submucous cysts containing minute worms. Weinberg* has given a very complete report of the macroscopical and microscopical appearances of the disease in anthropoid apes and monkeys. Œsophagostomiasis is an extremely rare disease in man. Brumpt reported the first case in 1905, in a negro from the Omo river near Lake Rudolph in East Africa.

Railliet and Henry described the œsophagostome in this case, naming it *Oes. brumpti*. Our case is the second to be recorded in man,

* Weinberg, M. Œsophagostomose des anthropoïdes et des singes inférieurs. Archives de parasitologie, T. XIII, No. 2, 1909.

and from the conditions found at the autopsy there can be no doubt that the patient died from a septic peritonitis due to the lesions caused by this worm.

The worms taken from the cysts were sent to Professor Railliet,* who most kindly volunteered to undertake the description of the parasite.

The history of the disease is unknown, as the patient entered the public ward of the Santa Casa de Misericordia in Manáos in an extremely critical condition. He was admitted to the Hospital suffering from acute dysentery; he became delirious, and died within three days. Our records describe him as a man, aet. circ. 36, a native of the Amazon State, Rio Purus region.

The autopsy was performed ten hours after death. Unfortunately the case occurred at a time when there were many other duties to be performed, and consequently the post-mortem was incomplete.

Body of an extremely emaciated man; colour mulatto; muscles well developed; scars on both tibiae from old boils. Subcutaneous fat very pale and scanty. Muscle fibres pale, brownish red and dry.

Thorax. Lungs emphysematous, slight hypostatic congestion of left. Pericardium contains two spoonfuls of cloudy flocculent fluid. Heart: left side slightly enlarged, muscle shows some hypertrophy, pale and friable. Several small recent atheromatous patches along aortic ring; mitral valves competent, very slight thickening; semi-lunar valves normal. No other atheromatous patches seen.

Abdomen. On opening the peritoneal cavity, the omentum and some coils of small intestine were found matted together on the right side, attached to the caecum and to the ascending colon by tough adhesions. The small intestine was distended with gas. On separating some adhesions, tiny pockets of pus opened. Surface of ileum, caecum and ascending colon dotted with small nodules. Spleen not enlarged, marked perisplenitis, capsule of organ on anterior superior surface had a large pinkish white area the size of a florin, cartilaginous, 2 to 3 mm. in thickness; no adhesions between it and diaphragm.

Liver slightly enlarged; few adhesions between surface and

* Railliet, A. et Henry, A.; Étude zoologique de l'œsophagostome de Thomas. Annals of Tropical Medicine and Parasitology, p. 89, Vol. IV, No. 1, 1910.

diaphragm; capsule dull, not thickened; organ pale, friable, cloudy swelling, commencing to decompose.

Kidneys slightly enlarged, very soft, especially the right; cloudy swelling. Decomposition advanced.

As the adhesions were very firm, the small intestine, caecum, ascending and transverse colon, were taken out *en masse* and placed in Kaiserling's fluid for later examination.

The following description of the affected bowel was made some months after it had been in Kaiserling's fluid:—

SMALL INTESTINE

Exterior.

The surface of the small intestine, extending from the ileo-caecal valve, for a length of about one metre, is studded with small raised, dark-coloured tumours; the majority of these involve the lower part of the ileum for a distance of 35 cm. from the ileo-caecal valve. The nodules are less numerous and pronounced in the remaining 65 cm. of the infected bowel.

Thirty-seven well-marked tumours can be counted. The greater number of them appear to be lying between the external muscular layer and the peritoneal covering of the bowel. The surfaces of the nodules are usually smooth, but some few are roughened and covered with plastic adhesions. The majority of these growths are small and oval in shape, and vary from the size of a small pin's head to 7 mm. by 9 mm. and elevated as much as 6 mm. to 8 mm. above the surface of the bowel (Plate IV, fig. 2). Some are flatter and more button-shaped (Plate V, fig. 5). Others again are elongated, leech-like masses. These latter (eight in number) measure from 14 mm. to 23 mm. in length and 6 mm. to 11 mm. in width; they project 4 mm. to 9 mm. above the surface; their base is somewhat constricted so that the contents of the cyst cause a bulging of the tumour walls (Plate IV, fig. 1).

The nodules are opaque and greyish-black in colour, with sometimes a few light ochre-coloured points in or underneath the cyst wall.

The situation of the nodules varies. Some lie along the mesenteric attachment; others are on the sides or upper surface of the gut. The larger tumours appear to lie on the upper wall and parallel to the

longitudinal axis of the bowel; some few, chiefly situated along the mesenteric attachment, are placed transversely.

The nodules are found either 4 cm. to 12 cm. apart or in small groups of three to five oval tumours separated by 1·5 to 2·5 cm. from one another. Occasionally, small clusters of two or three are seen lying close together (Plate V, figs. 3, 5, 6).

Many of the smaller tumours are hard and shot-like; some few are calcareous. The larger ones are soft, compressible and doughy, pitting freely on pressure. The tumours appear to be firmly attached to the wall of the intestinal tube. Provided the walls of the cyst are intact, very great pressure is needed to cause a rupture.

In three of the tumours, the outline of a coiled worm can be seen lying underneath the tightly stretched membranous covering.

At one place along the upper part of the ileum there is a triangular prolongation of the external muscular coat and peritoneum, and, from the apex, the ends of two small worms can be seen projecting (Plate IV, fig. 2; fig. 4 shows the same × 8). On examining the attachment of the mesentery to the ileum, a worm was found penetrating the mesentery; it had escaped from its cyst in the external muscular layer and still had its cephalic end within the cyst cavity (Plate V, fig. 10, × 8).

On opening these nodules a small worm is found lying in a semi-solid dark brown mixture. Each cyst contains one worm; in no instance have two worms been found in one cyst. One tumour may be composed of two and, in some cases, three to four cysts. The worm is found lying either coiled and twisted or stretched out.

Very often the head is damaged in pulling out the worm, as if its cephalic end had been embedded and fixed in the surrounding tissue. The cyst wall appears to consist of the peritoneal coat, and the floor, of fibres of the external muscular layer (p. 68). A small cyst which has been opened—the two ends of the worm being partially drawn out—is seen in Plate IV, fig. 2, and the same × 8 in Plate IV, fig. 3.

The intestinal tube was distended with gas, and at two places the bowel appeared to be sacculated, with a constriction at the lower ends of the pouches (p. 61). The walls seemed greatly thinned and very transparent, and, by transmitted light, other nodules could be seen attached to the inside of the bowel.

The ileum at its junction with the caecum is very contorted, and

surrounded by a mass of fibrous adhesions, omentum, appendices epiploicae, etc. In separating the ileum, a cyst, the size of a large pea, was ruptured, and an immature adult œsophagostome escaped. In the mass of adhesions, two other small cysts were found, but these were free from any connection with either caecum, colon or ileum.

Interior.

On opening the small intestine, some twenty nodules are seen situated in the walls, the majority of them causing a distinct bulging of the mucous membrane.

The greater number of the tumours are small and oval in shape, measuring 4 mm. by 6 mm., up to 5 mm. by 9 mm. Some few have an elongated form, 15 mm. by 6 mm. (Plate IV, fig. 2). Though causing this bulging of the mucous membrane, none of the tumours is so markedly elevated as those nodules situated on the external surface of the intestine. The average bulging of the mucosa, produced by the cysts, is from 1 mm. to 6 mm.

A few of the nodules on the external surface are seen to cause a bulging of the mucous membrane into the lumen of the bowel. They are all more or less flat tumours with broad bases (Plate V, fig. 5). (The opened cyst with a worm partially drawn out is one with these characters, Plate IV, fig. 2.) The long leech-like tumours (Plate IV, fig. 1) produce no bulgings into the lumen of the canal; they are nearly all situated over the areas of Peyer's patches, which are enlarged and slightly inflamed.

The tumours in the submucosa lie transversely or diagonally, a few longitudinally to the axis of the bowel, and the majority of them are situated along the attachment of the mesentery. These adhere firmly to the wall, and are generally harder than those on the external surface.

The walls of the bowel are unusually thin in places. At 23 cm. and 47 cm. from the ileo-caecal valve are two pouched areas (p. 60); the lumen of the bowel is considerably enlarged, and beyond the sacculations, are constrictions of the canal. Examination shows that the constrictions cause an actual narrowing of the lumen of the gut, forming partial strictures, so that it is difficult to introduce the tip of the little finger. Dilatation of the tube in the proximity of the constrictions has resulted in the formation of the two pouches. The

narrowing is due in the one case (pouch 23 cm. from ileo-caecal valve) to a large cystic tumour lying parallel to the longitudinal axis of the bowel and attached to that portion of the wall furthest away from the attachment of the mesentery. In the other case (pouch 47 cm. from ileo-caecal valve) two medium-sized cysts, which have apparently coalesced, are lying diagonally across the wall, and directly opposite them is another cyst lying lengthwise. In both cases the cysts have burrowed or fastened on to the two side walls, drawing and puckering them together and resulting in the constriction of the lumen. A few medium-sized cysts are attached to the walls of the dilated areas. It is probable that these pouches have resulted from the weakening of the walls by the damage caused by the cystic tumours and the over-distension of the canal: the intestinal contents, being hindered by the obstruction, tend to collect, and, through the peristaltic pressure from behind, dilatation of the already weakened and inelastic wall ensues.

CAECUM

Exterior (Plate I, Plate II, fig. 1).

The walls of the caecum are mottled with bluish-black, slightly raised, irregularly shaped areas, especially along the anterior and posterior longitudinal muscular bands. These areas are so closely approximated as to appear in places as one wide mass; closer inspection shows them to be a series of subperitoneal cysts covered over with thickened peritoneum.

Radiating from the longitudinal bands are transverse striae (Plate I), 4 mm. to 9 mm. broad, which stand out prominently by reason of their darker colouring. Along these areas are dull ochre-coloured, irregularly-shaped spots, varying in size from a pinpoint to 4 mm. to 7 mm.; some of these are very prominent. Other striae are outlined by a series of small ochre-coloured nodules the size of small shot, and are elevated 1 mm. to 3 mm. above the surface.

Three dark oval elevated tumours, measuring 6 mm. by 11 mm. to 13 mm. in length, and from 3 mm. to 5 mm. in height, are attached near the posterior band. They are similar to the ones on the outer surface of the ileum.

The walls of the caecum are very thick and rigid especially about the anterior band. On holding the opened up caecum to the light the dark areas can be seen as thickened masses, involving the greater part of the walls (Plate II, figs. 1 and 2).

Incision of the dark or ochre-coloured nodules shows various sized cavities containing immature adult œsophagostomes; the dark contents appear to be simply degenerated blood cells. The ochre-coloured cysts contain degenerated erythrocytes, and pus cells with many bacteria; the spots in the walls of the cysts are patches of necrosis or calcareous deposits (Plate II, fig. 1). Here, again, each cyst contains only one worm. The majority of these cysts appear to have originated in the subperitoneal fascia and to have spread into the external muscular layer. The peritoneal covering is enormously thickened by very old and tough adhesions which are difficult to strip off without rupturing some cysts.

Appendix vermiformis (Plate II, figs. 1 and 2).

The appendix at its junction with the caecum is surrounded on two sides, by a firm, dark-bluish tumour mass which so distorts its orifice as to make it almost impossible to pass a probe through the lumen into the caecal cavity. On opening up the canal the tumour mass is found to consist of a series of five cystic subperitoneal tumours, involving the wall of the caecum, and of a couple of large submucosal cysts which have invaded the neighbouring plica sigmoidea, with consequent bulging of the mucosa. The wall of the caecum at the junction is thickened and honeycombed with the five small subperitoneal cysts, each containing a worm.

About 1 cm. from the tip of the appendix is a bean-shaped nodule, 8 mm. by 10 mm., which is growing from the subperitoneal fascia of the wall. It does not involve the lumen. Microscopic examination reveals two small cysts, which are situated near the large one but are developed in the submucosa.

ASCENDING COLON

Exterior.

The walls of the ascending colon for its whole length are covered with thickened adhesions containing enlarged glands, fat and omental tissue. On attempting to strip the walls of these masses, many small, dark-coloured, cystic tumours are ruptured and small worms disclosed. So numerous are the tumours that it is impossible to remove the adhesions completely without spoiling the specimen.

The same dark-coloured, slightly raised areas are present, but are not so extensive as those developing in the walls of the caecum. The anterior longitudinal band is almost free from these areas and nodules. The posterior band is thickened and appears to be infiltrated along the whole of its length by hard masses. On the internal and posterior walls are eighteen small oval cystic tumours.

At two places between the internal and posterior bands the appendices epiploicae are thickened, and dissection exposes a small worm lying on the wall of the colon. In each case the worm is seen lying near the ruptured cyst from which it has evidently recently issued. The worm is lying on the wall of the bowel, free from its restraining cyst, and apparently only confined by the adhesions of the epiploica to the wall. The fascia around the worm is stained dark-brown, and microscopic examination shows very many red blood cells, some pus cells, and numerous cocci, streptococci and short colon-like bacilli. [Plate V, fig. 7, appendix epiploica turned back and worm in situ. The three light points seen near the worm are portions of worms belonging to other cysts. The covering over these cysts is very thin, and was torn when turning back the epiploica. The exit-hole made by the œsophagostome is seen as a dark spot above and slightly to the right; specimen × 16.]

Caecum (Plate II, fig. 2; Plate III, fig. 1).

Interior.

On examining the interior of the caecum, a number of cord-like, ribbed, opaque masses attract the attention. They infiltrate the walls of the gut, usually following and involving the plicae sigmoideae, and, by their development in the submucosa, cause the mucous membrane to project prominently into the caecal cavity. These cord-like masses radiate from one muscular band to another, the anterior and posterior bands being particularly involved. As depicted in Plate III, fig. 2, these rows of cystic tumours, while well separated from one another, tend to merge into a common centre and form compact masses, especially about the anterior and posterior bands; the internal band is less affected. In between these radiating rows of cysts, other cyst tumours are present, so that there is very little free wall-area unaffected. The

coalescing of so many tumours produces at these centres a great thickening of the wall, as is well seen in Plate II, fig. 2, and Plate III, fig. 1.

The cysts composing these strands are of varying dimensions, measuring 8 mm. by 3 mm. to 40 mm. by 4 to 7 mm. It is difficult to determine the exact length of some of the tumours without opening them. Some of the largest tumours, on being incised, are found to consist of a row of five to seven equal-sized cysts. Others again, with irregular outlines, and all the appearances of a series of cysts lying end-on-end, prove to be composed of one or two long cysts.

The cysts are soft and very compressible, differing from the harder cysts encountered in the ileum. Many of the spongy cysts have their walls dotted with yellowish areas. A few of these areas are actual sloughs, and quite moderate pressure suffices to rupture the necrosed wall. There are no calcareous patches. The bulging of the mucosa caused by these cysts is pronounced and varies from 3 to 5 mm. up to 9 mm. along the plica sigmoideae. Plate III, fig. 1 depicts a medium sized distended cyst, and through the thinned and tightly stretched mucosal covering the outlines of a large worm can be easily seen. This cyst was continuous with a large cyst in the external muscular coat, which bulged inwards as well as outwards.

On making a cross-section through the caecum, a striking picture is obtained. The wall in the vicinity of the longitudinal bands is thickened by dense fibrous tissue and honeycombed by a number of cysts of different sizes. Many of these cysts have been cut through, and parts of worms are lying in the cyst cavities (Plate V, fig. 2). The cysts appear to be situated in the subperitoneal and submucosal fascia; some lie between the internal and external muscular coats of the bowel. Some cross-sections show that all three forms of cysts have developed through being superimposed on each other. In such a case, the submucosal and intramuscular cysts appear to be of older and the subperitoneal cysts of more recent growth. The cysts with much cicatrical tissue around them are usually empty and may be partially calcified.

The thickness of the wall varies. At the anterior band it is 6 mm. to 9 mm., and in betwen the clusters of cysts the bowel wall is thinned and very transparent (Plate II, fig. 2).

Ileo-caecal valve.

The segments of the valve are thickened and infiltrated by submucosal cysts. The edges of the upper segment are distorted by five, the lower segment by two small cysts. The bases of the segments and floor of the gut are infiltrated by nine medium cysts. The plica sigmoidea, opposite the valve, is invaded by a large cyst in the submucosa.

Colon. (Interior.) Plate I; Plate III, fig. 2.

Of the 32 cm. of the ascending colon invaded by these tumours, the first 13 cm. exhibit the greatest changes. Tumours of all shapes and sizes are occupying the walls and floor of the gut, where, developing in the submucosa, they have caused prominent bulgings of the mucous membrane. Some of the tumours are the size of small nuts, measuring 17 mm. by 8 mm. and 9 mm. thick. Many of the tumours are oval in shape, others have the character of the leech-like cysts seen on the outside of the ilcum (cf. Plate IV, figs. 1 and 2). Other tumours are bunched together or arranged in long rows, infiltrating and distorting the plicae sigmoideae.

Raised, yellowish patches are seen in some of the cyst walls; the mucous membrane surrounding them is ulcerated. Examination shows these necrotic areas to be small abscesses. The long tumours are soft and fluctuating, and present the usual characters of the submucous cysts.

The cyst tumours are developed on the sides and floor of the bowel, the majority being arranged transversely to the axis of the colon; the posterior wall appears to be the most infiltrated. In between the areas of cystic tumours the tissues of the walls appear thinned and inelastic.

A cross-section of the colon 14 cm. from the ileo-caecal valve, and through an infiltrated part, shows the wall to be thickened from 6 mm. to 11 mm. and to present the same honeycombed appearance observed in the caecal walls (Plate I; Plate V, fig. 1). The same subperitoneal, intramuscular and submucosal cysts are seen; the cysts appear to be closer together. In a cross-section 24 mm. long, seven cysts (five subperitoneal, two submucosal) were exposed; each cavity contained parts of a worm. No calcareous deposits were found, but microscopic

examination showed several foci. If the bowel wall at the side of a submucous cyst be incised, little difficulty is experienced in shelling out the cyst intact, which then appears as a thin membranous sac containing a worm. It is impossible to shell out old submucous cysts with much fibrous tissue, or subperitoneal cysts, without rupture of the wall.

MICROSCOPICAL EXAMINATION

Nodules from various parts of the small and large intestine were imbedded in celloidin or paraffin and, where possible, serial sections were made. Many of the nodules in the wall of the caecum and colon required decalcification before imbedding. The serial paraffin sections were affixed to the slide with glucose-dextrose solution and, after drying, were passed through toluol and alcohol and flooded with thin celloidin. The film was allowed to harden and the slide was then placed in water to dissolve the glucose; the sections protected by the thin celloidin covering floated off and could he manipulated with ease. Van Gieson and Weigert's elastic tissue stains were found of service.

Ileum

Oval submucosal cyst. Cut transversely.

The cyst has developed in the submucosa; though distended the cyst does not appear to press on either the muscularis mucosae or the internal muscular coat. The walls of the cyst are of thickened connective tissue. The cystic contents appear to consist almost entirely of degenerated erythrocytes; a few large mononuclears are present. In some of the sections portions of a worm are seen cut across. The cyst wall is infiltrated with numerous mononucleated cells and some small round lymphoid cells.

Examination with a higher power, shows that the cystic contents contain a few perfectly preserved red blood cells, and a few large mononucleated polygonal-shaped cells which contain a few pigment granules. Small clumps of granular pigment are scattered about. The cross-section of the worm shows that there are many degenerated as well as some normal red cells in the intestine. The cyst wall is infiltrated by large mononuclears and granulation cells, the infiltration being more dense in the inner part of the walls. The side abutting on the internal muscular coat is especially infiltrated, the infiltration extending halfway through the internal muscular coat. The tissue of the submucosa exhibits a slight infiltration of mononuclear leucocytes, but the muscularis mucosae and mucosa are entirely free. The vessels in the cyst area are engorged with blood; many of tbem contain numerous mononuclear leucocytes. Traversing the internal and external muscular coats are large cells containing pigment granules; none of these cells is noticed in the mucosa. No eosinophiles are to be found.

Oval submucous cyst with necrotic patch on wall projecting prominently into intestinal canal.

The cyst has developed in the submucosa and has involved the inner fibres of the internal muscular coat. The distension is extreme and has caused a very prominent bulging of the mucous membrane. The fibres of the muscularis mucosae are not atrophied but appear to be thinned. The necrotic patch in the mucous membrane proves to be only a superficial ulceration which does not extend to the deeper layers nor involve the muscularis mucosae. There is very little infiltration of tbe internal muscular coat or of the tissues in the immediate vicinity of the cyst. The contents

of the cyst comprise large mononuclears, some polymorphonuclears, a few large hyaline cells and some pigment-containing cells, these latter are situated at the periphery of the cyst. The red blood cells are nearly all degenerated. A longitudinal section of a worm is present and in the intestine several polymorphonuclears, mononuclears and a few degenerated red blood cells are seen. The walls of the cyst have a well-marked necrotic lining, in which are a few polymorphonuclear leucocytes. The connective tissue of walls is infiltrated by large mononucleated cells, and a considerable number of eosinophiles. Pigmented cells are seen in rows, directed towards the subperitoneum. The intermuscular space contains very distended blood vessels.

Subperitoneal cyst; leech-like tumour; longitudinal section.

Serial sections show that the cyst has developed in the loose areolar tissue of the subperitoneal space and that the fibres of the external muscular coat are not involved nor atrophied. The tumour has everted the peritoneum and has so developed that the sides and ends bulge and overhang like a mushroom. The cavity of the cyst measures over 8 mm. in length. The walls of the tumour are formed of thickened connective tissue which is greatly hypertrophied at the two ends. The cyst is not partitioned and the cavity is filled from end to end with many degenerated cells, some red cells, mononuclear leucocytes, and two sections of a worm, a transverse and a longitudinal one. The thickened cyst walls, especially the two end and basal walls, are infiltrated with leucocytes.

Near one end of the cyst, is a well-defined necrotic area which occupies the whole thickness of the internal muscular coat; the submucosa and internal fibres of the external muscular coat in the vicinity of this necrosis are infiltrated by large mononuclear cells.

Lying in the cavity are masses staining lightly with eosin and possessing no nuclei. Some are long elongated bands which appear to consist of degenerated fibres of some kind. With high magnification, they resemble the cuticular remains from the moult of the worm. The red cells are grouped around the worm, but none is seen inside it. The mononuclears and large polygonal cells are most numerous at the sides of the cavity. The tissues of the retaining walls immediately around the cyst are infiltrated by rows of large mononuclears and small lymphocytes; eosinophiles are very numerous; only a few large pigmented cells are found. Less infiltration and fewer eosinophiles are noted in the outer part of the walls. The end walls of the cyst show extensive thickening with very little infiltration in the outer layers, but, further in, the tissues are densely infiltrated. The external muscular coat is infiltrated by a few mononuclears which extend to the intermuscular space.

The circumscribed necrotic area in the internal muscular coat is filled with many large mononuclears, a few erythrocytes and large hyaline cells containing a little pigment. Outside the necrotic area, is an intense infiltration of small round cells and large mononucleated cells which extend through the entire coat and involve the intermuscular space and the contiguous fibres of the external muscular coat; on the other side they penetrate the submucosa, where the infiltration is not so great, and does not extend to the muscularis mucosae.

In another leech-like cyst the development has begun in the outer fibres of the external muscular coat and extended to the subperitoneal space. The cyst is more distended and the cells bulge prominently. The parietal wall is covered with layers of plastic exudate. The cystic contents have more red blood cells and a considerable number of pigmented cells and free pigment granules: very few eosinophiles are seen. The infiltration of the walls is less marked and more small round cells are present. No masses resembling the cuticular remains of the moult of the parasite are to be found. A small haemorrhagic cyst lies adjacent, in the submucosa, distending the space and lifting up the muscularis mucosae; the fibres of the internal muscular coat adjoining the cyst are somewhat atrophied, and there is considerable infiltration of this layer with mononuclears, large pigmented cells, a few eosinophiles and large giant cells. The contents of the cyst are composed of masses

of degenerated and some few normal red blood cells and pigmented leucocytes. A cross section of a worm shows the intestine to be crowded with more or less well preserved erythrocytes and some pigment granules. The pigmented leucocytes appear in little rows extending towards and into the subperitoneal space. The mucous membrane, though distended, is intact. The iron reaction is easily obtained.

Section of two small nodules, lying close together on the surface of the ileum.

These cysts are entirely separated from one another. They have originated in the external muscular coat and have distended the subperitoneum. The larger one has invaded the whole thickness of the external and extends to the outer half of the internal muscular coat; the smaller one is limited to the outer fibres of the external muscular coat, and does not greatly distend the subperitoneum. The larger cyst contains the usual cells, the pigment granules are quite numerous, but few pigmented cells are seen. Two sections of a worm occur. The infiltration of the cyst wall is not extensive, and very few eosinophiles are present. The small cyst contains numerous polymorphonuclears and a few pigmented leucocytes; the erythrocytes are very hard to find. No section of a worm is seen. The cyst wall of the external side is necrotic and infiltrated with polymorphonuclears and small round cells; on the internal or visceral side, the wall is densely infiltrated with large clumps of eosinophiles, some small lymphocytes, and a few pigment-containing cells.

Cyst in the internal and external muscular coats.

This cyst creates a bulging both on the inside and outside of the bowel. It is dumb-bell-shaped and involves the inner half of the external coat and the whole of the internal muscular coat; it is situated diagonally to the longitudinal axis of the bowel. The two broad bases are joined by a narrower part or funnel. A section of a worm is lying in the internal part. The contents consist of many pigmented leucocytes and a large number of erythrocytes and pigment granules. In the cavity of the cyst, in the internal muscular portion several very large giant cells containing pigment granules are present. The cyst walls, composed of muscular fibres, are extensively infiltrated by mononucleated leucocytes and granulation cells; the part in the internal coat contains several giant cells. The lymphatics to the subperitoneum contain many mononuclear pigmented leucocytes. The vessels in the intermuscular space are filled with mononuclear leucocytes and normal looking red blood cells. Some of the veins are compressed by the extensive infiltration.

Cyst in the external muscular coat over a Peyer's patch.

The cyst extends through the whole of the external and part of the internal muscular coat; the infiltration is extensive and reaches as far as the submucosal space. The contents of the cyst are leucocytic, and do not present any unusual characters; no giant cells are seen. The walls are infiltrated by large mononuclears, some small lymphocytes, and a very few eosinophiles; the infiltration extends to the middle of the submucosa, but no cells have passed the muscularis mucosae. The epithelial cells of the mucous membrane are swollen, and many are slightly necrotic; the lymphoid tissue of the glands is congested and small mononucleated leucocytes are quite numerous.

Other portions of the ileum which, apparently, contain a submucosal cyst, on microscopical examination, are found to consist of collections of small tumours which lie closely together, but are absolutely distinct. It is not unusual to find two or three small cysts in the submucosa and one, rarely two, in the internal muscular coat. It is quite common to find submucosal and external muscular cysts in the same piece of bowel, and these, by their invasion of other coats, closely approximate one another. On only one occasion have there been found cysts in each of the coats, viz., submucous, internal and external muscular coats. In this respect the cysts of the large intestine differ, as it is most common to find cysts situated in the different coats lying close to one another.

On examining sections from three different portions of the ileum, in addition to the ordinary cysts containing large œsophagostome larvae, minute larvae of a nematode are found situated in various parts of the bowel wall. In one piece many larvae are situated in the subperitoneal space, cut transversely, or a portion of one is lying stretched out, or again, a coil or two are to be seen. They occur in the neighbourhood of the blood vessels, but none is seen within. In the second piece of gut, the large cyst invades the whole of the internal muscular coat, part of the external muscular coat and a portion of the submucosal space. Directly under the muscularis mucosae but outside the cyst are seven portions of minute larvae in cross section. In the third portion little sections of minute larvae are present in the external muscular coat and in some of the sections numerous cross-sections of larvae are found in the deeper part of the submucosa. Weinberg* describes minute larvae in the muscular coats of the large intestine, but they appear to be surrounded by a fibrous sheath which is not seen in any of the sections which I have examined. I submitted some sections to Dr. Weinberg,† but he was unable to give an opinion regarding the cross-sections of these small larvae.

Caecum

Cord-like tumour of caecal wall.

This proves to be a very elongated submucosal cyst, occupying the entire space of the submucosa, and involving the inner half of the internal muscular coat, and an intermuscular cyst invading both muscular coats, and infiltrating but not distending the subperitoneal space. The fibres of the muscularis mucosae are somewhat atrophied and the mucous membrane displaced.

Large mononuclears, polymorphonuclears and enormous vesicular cells, and a few eosinophiles with products of degeneration form the cell contents of the cyst; erythrocytes can only be found with great difficulty. Two transverse sections of the worm show many polymorphonuclear and a few mononuclear leucocytes in the interior of the intestine. The cyst walls are extensively infiltrated with mononuclear and lymphoid cells; thick rows of eosinophiles occupy the middle layers and extend with the infiltration of mononuclears and small normal cells to the muscularis mucosae. The internal muscular coat and intermuscular space show the same degree of infiltration. In the deeper part of the submucosa, in the immediate neighbourhood of the cyst, are two large giant cells occupying the centre of a clump of small round cells. No pigmentation of the leucocytes is observed Small clumps of minute bacilli are present in the cyst cavity.

The cyst in the internal and external muscular coats resembles an hour-glass,

---

* Weinberg, M. *loc. cit.*, p. 193.

† 'Il n'est pas douteux que les grosses larves sont celles de l'œsophagostome Elles resemblent beaucoup à ce qui je trouve dans mes preparations.'

'A côté d'une grosse larve se trouve, comme vous l'avez vu, un œuf. Seulement, il est tellement imprégné de matière colorante qu'il est impossible de voir sa structure. Il ne faudra cependant pas vous étonner si un jour vous trouvez dans un nodule hémorrhagique un nématode complètement adulte. C'est exceptionnel, mais cela existe. Vous trouverez l'indication d'un cas semblable au bas d'une page de mon travail d'ensemble (p. 202) Archives de Parasitologie.'

'Il est intéressant que dans la paroi de vos nodules il existe une forte infiltration par des cellules éosinophiles, ce qui n'existe pas toujours chez les singes.'

'Je n'ai jamis vu de nodules parasitaires dans les ganglions lymphatiques Je les ai vus dans la paroi de l'estomac, dans la paroi abdominal, dans le diaphragme.'

'Il est impossible de dire si les petites larves, dont on voit un très grand nombre dans la partie profonde de la sous-muqueuse, sont bien les larves d'Oesopbagostome; c'est possible mais je ne puis pas l'affirmer.' (April, 1910.)

the constricting area being at the level of the intermuscular space. The contents are rich in degenerated erythrocytes and a few pigmented mononuclears. A large pigmented giant cell is situated alongside a longitudinal section of the head of a worm. The walls are infiltrated almost exclusively with small round cells and some mononuclears. The vessels in the neighbourhood are filled with erythrocytes and mononucleated leucocytes. The infiltration in the subperitoneal space is not intense and consists of mononuclears and a few small round cells. Minute traces of pigment are observed in many of the leucocytes collected about the small veins; no pigmented cells are seen inside the vessels.

Cord-like tumour with small necrotic patch in mucous membrane.

It was found impossible to cut out the mass from the wall of the caecum without dividing a cyst in the subperitoneum. A small immature female œsophagostome was drawn out. Section of wall was 24 mm. long, the tumours occupied 20 mm. The submucosal tumour consists of a series of cysts occurring in a group of three small submucosal cysts lying alongside one another, a fourth and larger cyst occupying the entire submucosal space, a fifth cyst in the internal and external muscular coats, a sixth and minute one in the submucosa, the seventh being a slightly larger one in the submucosa and involving some fibres of the internal muscular coat. On the peritoneal side of the section is seen the subperitoneal cyst divided, and near at hand, a dark brown mass occurring in the loose tissues of the subperitoneum.

The contents of the group of three tumours vary considerably. The outer cyst is composed almost entirely of mononuclear leucocytes and a few pigment cells. A diagonal section of a worm contains a few mononuclears. The outer half of the adjoining walls are infiltrated with eosinophiles. The second cyst contains a number of partially degenerated erythrocytes and some large mononuclear and pigmented leucocytes, the transverse section of the worm showing that there are many erythrocytes in the intestine, and slight pigmentation of some of the cells lining the gut; the walls are infiltrated with many more mononuclear leucocytes than the first cyst, and contain many eosinophiles; pigmented mononuclears are seen traversing the muscular coat.

The two cysts lie very close together and do not distend the submucosal space.

The third cyst contains no worm, and its contents consist chiefly of polymorphonuclear leucocytes and a few large pigmented mononuclears, and, in the wall next to the fourth or larger cyst, are several large peripherally pigmented giant cells. The tissues of this wall are necrotic, especially the outer ones, a condition due to the extensive necrotic condition of the fourth cyst. The infiltration is particularly intense about the wall adjacent to the internal muscular coat.

The fourth cyst contains two cross sections of a worm and exhibits all the characters of an abscess. Pus cells are numerous; many Gram-positive cocci and short bacilli are present in the cyst and also in the intestine of the worm. The walls are necrotic and the necrosis extends to the mucosa, where there is a small necrotic ulcer. The infiltration of mononuclear and polynuclear leucocytes is very extensive, and part of it extends to the fifth cyst, which is situated in the two adjoining halves of the internal and external muscular coats. The number of eosinophiles present is scanty, and no pigment or erythrocytes can be seen.

The fifth cyst occupies the outer half of the internal and the inner half of the external muscular coat. The cavity is small, and is filled with mononuclears and a few large polygonal non-pigmented nucleated cells. A cross-section of a worm contains only mononuclear cells. The muscular walls of the cyst are moderately infiltrated with mononuclear, small round cells and a few eosinophiles.

The sixth cyst is a minute one in the middle of the submucosa. It is free on all sides, and does not exhibit any great infiltration of the cyst walls. Red blood cells, many of them well preserved, a scanty number of mononuclears, free pigment granules, and a few pigmented leucocytes comprise the contents of this cyst. A cross-section of a small worm contains hardly any blood cells. The connective tissue of

the walls is infiltrated with some erythrocytes, mononuclear cells, and a few pigmented leucocytes.

The seventh cyst is small and in the submucosa, but it involves some of the fibres of the internal muscular coat. Mononucleated leucocytes and degenerated erythrocytes, with a section of a worm containing some pigmented cells and a few degenerated erythrocytes, are found in the cavity of the cyst. Two thin incomplete bands of connective tissue practically subdivide the cavity into three little chambers which communicate with one another. The walls show a moderate infiltration of mononuclears, small round cells and a great number of eosinophiles. Small rows of pigmented cells cross the muscular coats and are collected in little clumps in the subperitoneal space.

It is evident that the fourth cyst was infected from the ulcer of the mucous membrane, and that the necrosis extended to the third cyst.

Colon

Section through thickened wall of colon at level of fold of mucous membrane.

Cross-section of the wall shows two small cysts in the submucosa, under the fold of mucous membrane. Their contents are purely haemorrhagic, and only comprise erythrocytes and a few mononuclears with a section of a worm in each cyst. In the internal muscular coat is a long narrow cyst with dense fibrous cells. The contents of the cyst are degenerated red blood cells, pigment granules, and several giant cells containing considerable pigment; a cross-section of a worm is seen with a few fibrous-looking cells in its intestine. The cyst is confined to the internal muscular coat. A small cyst is situated in the external coat and extends to the subperitoneum. The intermuscular space is infiltrated by mononuclear leucocytes and a few eosinophiles. The contents of this cyst are mononuclears and degenerated erythrocytes, with a small section of a worm; no giant or pigment cells are seen, but there is a considerable number of eosinophiles. Near this cyst, but apparently developed in the subperitoneum, is a fibrous enclosed cyst. The cavity contains the remains of degenerated red blood cells and a few polymorphonuclear cells. No worm is found. Strands of apparently new connective tissue cross the cyst. A calcified area is present at one end. The walls contain some mononuclear leucocytes, and a few giant cells are in the side adjoining the internal muscular coat. The outer peritoneal covering is covered with layers of fibrous exudate. No bacilli are found in the cyst, but in the outer layers of the exudate a few small bacilli are present.

Cysts invading the ileo-caecal valve.

A small nodule was sectioned, and found to consist of a submucosal cyst which had apparently ruptured and allowed the escape of the worm. The contents were scanty and comprised a few mononuclears with a number of small round cells. Much new connective tissue was present in the cyst cavity. No bacilli were found. Giant cells were present in the submucosal tissue immediately beyond the wall of the cyst.

Tumour developing in the base of the valve segment. It comprises two small cysts, each containing cross sections of a worm, which distend the submucosal space and press upon the muscularis mucosae. Pigmented leucocytes are very numerous, but no giant cells are seen. The infiltration of all three cysts is slight, and consists of large mononuclears, small lymphocytes and a few eosinophiles. The vessels in the neighbourhood are full of normal-looking red blood cells and mononuclears.

Various other nodules in the caecum and colon were sectioned and found to have the characters already noted in nodules occurring in the ileum. Several submucosal cysts were examined which were immediately below small ulcerations of the mucous membrane. The tissue of the mucous membrane was seriously degenerated, the area was partially denuded of cells and the lymph follicles swollen, but

the cyst walls were not attacked so long as the muscularis mucosae remained intact. In one case the necrosis affected the outer half of the adjacent cyst wall.

Examination of the extensive black patches occurring in the wall of the gut has been unsatisfactory. Some of the patches are situated in the submucosa, others are in the subperitoneal space. The patches are caused by extravasated blood, and many well-preserved erythrocytes are still present; much blood pigment has been soaked up by the surrounding tissues, while only a moderate number of macrophages contain pigment. One or two patches in the subperitoneum, in the vicinity of cysts were invaded by large giant cells, many of which contained pigment. Evidences of repair were present in all the extensive areas. Iron pigment was rarely demonstrable. No traces of œsophagostome larvae or ova have been found.

Appendix vermiformis. Subperitoneal tumour, sectioned transversely.

This large cyst has developed in the subperitoneal space of the wall of the appendix, and from there has extended outwards into a cyst-mass larger than the appendix. The external muscular coat of the appendix is not involved. Between the external muscular coat and the tumour, the large blood vessels are seen cut across; these are filled with red blood cells and some leucocytes. Other blood vessels follow the peritoneal fascia along the tumour wall, penetrating to the interior of the cyst. The walls of the cyst consist of well organized connective tissue, and from the main walls thick strands cross the cavity and divide it into two main parts. A study of serial sections proves that the cyst tumour consists of an internal or proximal and an external or distal cyst. They are separated by the main divisional wall, which is continued completely across, from the upper to the lower walls of the tumour. These cysts are subdivided into small chambers by incomplete side walls of connective tissue. In one of the chambers of the distal cyst two transverse sections of a worm are seen; in other slides longitudinal sections of the cephalic end of the worm are found in the larger chamber of the external cyst. The serial sections show that the proximal cyst contains no worm.

The contents of the cyst are mainly leucocytes and red cells. Great numbers of polymorphonuclears are present in the cyst chambers, and the partition walls are infiltrated by mononuclears.

Higher magnification. The contents are nearly all pus cells with a few well-preserved and many degenerated erythrocytes, a few mononuclears, free pigment, and granular débris. The outer walls of the proximal cyst are lined with well-preserved pavement epithelium. The connective tissue is infiltrated by masses of mononuclears and some small round cells. Very few eosinophiles are seen. The blood vessels are large, and the veins are filled with many polymorphonuclear and mononuclear leucocytes, and well preserved erythrocytes. No bacilli or cocci are to be found. The sections of the worm show that the intestine contains some normal-looking and degenerated red blood cells. Large pigmented cells are found in the proximal cyst, and a few giant cells are in the wall.

The spleen sections show a very marked hyperplasia of the connective tissue of the capsule in which are numerous capillaries full of erythrocytes and some mononucleated leucocytes; in places the fibres are undergoing hyaline degeneration. The fibres of the upper strata are infiltrated with mononuclear and polymorphonuclear leucocytes; the lower strata of the fibrous mass is not so much infiltrated. Golden brown to black pigment is scattered throughout the spleen in small and large clumps. It is especially marked about the blood vessels in the trabeculae and in the centre of the follicles. Many lymphoid cells appear to be degenerated; large mononuclear cells are present in the sinuses and lymphatics. An overgrowth of fibrous tissue has occurred in the tissue near the capsule. Many cells stain badly, but this may be due to decomposition. This is especially the case with the liver and kidneys.

The liver exhibits slight interstitial changes; small round cells are collected around the portal sheaths, golden brown to blackish pigment is deposited in some of the peripheral cells of the lobules and in the interspaces. The organ shows extensive decomposition, and large bacilli are present.

The kidneys evidence cloudy swelling, and the vessels are filled with blood. The organs are too decomposed to admit of more exact determination of the changes present.

The heart muscle is degenerated and the fibres show some fatty degeneration. The muscle of the left ventricle is hypertrophied, and contains some brownish-black pigment granules, which do not give the iron reaction. Around the aortic ring is a pronounced area of old atheromatous changes, and one or two of the plaques are calcified.

The mesenteric glands show hyperplasia of the connective tissue reticulum; the lymphoid cells are increased, and large mononuclear and multinucleated cells are present. Pigment granules are found, but not in any great number. Eosinophiles are especially numerous in the small retro-caecal glands. In some of the glands near the diseased bowel, spots of necrosis are found; the lymphoid cells stain badly, and are very granular; polymorphonuclear leucocytes are accumulated in the lymph spaces.

The Brazilian case of œsophagostomiasis corresponds to the cases of the disease, occurring in apes and monkeys, described by Weinberg. In certain important points the case in man differs. The lesions are more extensive in the Brazilian case; more tumours are formed, and greater damage appears to have been caused to the wall of the bowel. The œsophagostome larvae have developed in the small intestine of the man, an unusual occurrence, as Weinberg has not recorded such a situation, and it was believed that the cysts of œsophagostomes were limited by the ileo-caecal valve. It is probable that the cysts in the ileum are of more recent development than those in the caecum and colon.

Weinberg records the presence of an adult female œsophagostome and of spherical eggs measuring 52 μ, in the cyst cavity of a nodule taken from the caecum of a chimpanzee, and, in another case, he has found minute larvae in the muscular coat. In the Brazilian case I have not as yet succeeded in discovering either a mature worm or the ovum. More tumours are still being sectioned in the hopes of finding an adult œsophagostome, which would help to explain the presence of the small sections of larvae in the submucosa, subperitoneum and intermuscular spaces.

The data obtained from examination of twelve nodules of the ileum, eleven of the caecum, three of the ileo-caecal valve, one of appendix vermiformis, and nine of the ascending colon allow of the following conclusions being drawn:—

1. The œsophagostome larvae,* as stated by Weinberg, reach the bowel by way of the blood. The larvae rupture a small blood vessel and become encysted in the submucosa, in the internal or external muscular coats of the bowel or in the subperitoneal space. In no case has a cyst been found above the level of the muscularis mucosae. The favourite sites for the development of the cysts appear to be in the submucosa and external muscular coat with invasion of the subperitoneal space. Cysts developing primarily in the internal muscular layer are not uncommon. The subperitoneal space appears to be a favourite site for the cysts of the ileum, but in the caecum and colon it is extremely rare to find a subperitoneal cyst. Nearly all the cysts have developed in the outer fibres of the external muscular coat and have immediately extended to the looser tissues of the subperitoneal space. In no case has a cyst been found to contain more than one worm.

2. The worm can moult and become an immature œsophagostome and leave its cyst cavity. Weinberg has found them in the lumen of the intestines. An empty cyst can become cicatrized or calcified. Acute inflammation of a cyst does not affect the larva.

Necrosis of one cyst can extend to another one lying in the immediate vicinity. The amount of infiltration around a cyst depends to a certain extent on the amount of irritation produced by the worm. Weinberg has shown that the œsophagostome can produce haematoxic substances analagous to those secreted by the sclerostome of the horse, and it is probable that this affords an explanation of the number of eosinophiles observed around some cysts and not around others, although they may be lying close at hand. The infiltration can be induced by bacilli entering the cyst by way of the blood stream, or by ulceration of the distended mucous membrane.

The haemorrhagic contents of the cysts and the degeneration of the blood cells cause the formation of iron pigment, which can be taken up by large leucocytes and conveyed to the subperitoneum. Iron pigment has been found in large quantities in the spleen and, to a less extent, in the liver and mesenteric glands.

---

* The larvae obtain nourishment from their host. Many erythrocytes have been found in the lumen of the intestine of a worm. Pus cells and bacilli are frequently found if the contents of the cyst are septic.

Plate I.

Caecum and ascending colon. Along the longitudinal muscular band some of the raised, dark, transverse, haemorrhagic, subperitoneal cysts can be seen, also two small oval ones. Large tumour masses are developed in the submucosa; many of them have been opened up. Note the transverse arrangement of the cysts. The raised ochre-coloured patches are foci of necroses occurring in the cyst walls, and the surrounding mucous membrane is inflamed and ulcerated. A large submucosal tumour is seen in the lower third of the plate. (Compare Plate III, fig. 2). The cut surface of the cross-sections gives a good idea of the amount of infiltration caused by these cysts, and the honey-combed condition of the wall about the longitudinal muscular band is especially well seen in the lower portion of the drawing. (Compare Plate V, figs. 1, 2.)

C.N Censi del ad nat.

Werner u Winter Frankfurt a M

ŌEsophagostomum stephanostomum var Thomasi.

Plate II.

Fig. 1. *Caecum and appendix.* External surface. The gut was held up to the light in order to show more clearly the extent of the black haemorrhagic patches. Note the black areas at the apex. These are masses of subperitoneal tumours infiltrating a longitudinal muscular band. Some necrotic and calcareous patches are seen coloured yellow. *Appendix vermiformis.* Probe passed through lumen into caecum. Notice tumour mass on wall of caecum; it is composed of a number of submucosal and subperitoneal cysts.

Fig. 2. Compare Plate III, fig. 1.

Interior of Caecum. Edges of bowel held apart, and tumour masses depicted by transmitted light, so as to show the thickening, and the cord-like appearance of the cysts. These masses are composed of a number of submucous, haemorrhagic cysts near each other. Note the general tumour development at the upper and lower portions of the drawing; these correspond to the clusters of submucosal and subperitoneal cysts about the longitudinal muscular bands. Probe passed through appendix.

1

2

0 1 2 3 4 5 6 7 8 9 10 m

C.N Censi del. ad nat.

Werner u. Winter fra. ed. m.

ŌEsophagostomum stephanostomum var. Thomasi.

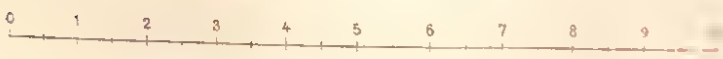
PLATE III.

Fig. 1. *Caecum.* The cord-like, twisted masses of cysts are all merging into one broad area (here it is the anterior longitudinal band). Note the outline of a worm showing through the greatly thinned mucous membrane. The thickening of the wall is well seen. (Compare Plate II, fig. 2.)

Fig. 2. *Interior of colon.* A number of submucous cysts are seen. In the upper left-hand corner of the drawing is a large cyst, (in Plate I, seen in lower third of drawing), the size of a large bean. Note the necrotic patches in some of the cyst walls.

1

2



C.N. Censi del. ad nat.

ŌEsophagostomum stephanostomum var Thomasi

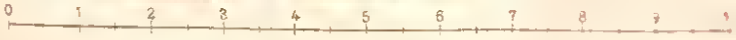
Plate IV.

Fig. 1. *External surface of ileum.* The large leech-like masses are subperitoneal haemorrhagic cysts. Each mass is composed of one cyst.

Fig. 2. *External and part of internal surface of ileum.* Portion of intestine showing small oval and leech-like cysts. Cyst opened and worm partially withdrawn. (Compare fig. 3.) To the extreme right of drawing is a triangular piece of the hypertrophied external muscular and peritoneal coats of the bowel, and from the end are seen projecting portions of two worms. (Compare fig. 4.) Below this is a long cylindrical submucosal cyst.

Fig. 3. Small oval cyst as depicted in fig. 2. × 8.

Fig. 4. Hypertrophied external muscular and peritoneal coats, showing the ends of two worms as depicted in fig. 2. × 8.



C.N Censi del ad nat.

ŒEsophagostomum stephanostomum var Thomasi

Plate V.

Fig. 1. *Cross-sections of wall of colon and caecum.* Infiltration and honeycombed condition produced by submucosal, subperitoneal or intra-muscular cysts. Note the size of some of the cyst cavities, and the number of cysts in a small piece of bowel wall. The hyperplasia of the fibrous tissue is well seen and resembles the rings of a tree-trunk.

Fig. 2. *Wall of caecum.* Thickening of wall by fibrous tissue. This cyst was greatly inflamed.

Fig. 3. *Ileum.* Two small nodular subperitoneal cysts. They do not communicate with one another.

Fig. 4. *Small omental gland*, showing œsophagostome partially withdrawn. It had penetrated the gland and become encysted. × 12.

Fig. 5. *Ileum.* Two small, flat, button-shaped subperitoneal cysts. The cysts are quite separate.

Fig. 6. *Ileum.* Note subperitoneal cyst on side of mesenteric attachment. It is attached to the side wall and, with two small submucosal cysts, has produced a puckering of the wall of the intestine. Several of these cysts produced a sacculated condition of the tube.

Fig. 7. *Œsophagostome* lying on external surface of colon. The gastro epiploica, by which it was covered, is turned back. Note three small yellowish points near the worm; these are parts of worms in other cysts. The membranous coverings of the cysts were very thin, and were torn in drawing back the pad of fat. The small dark round spot is the hole made by the worm escaping from its cyst. × 16.

Fig. 8. *Colon.* Œsophagostome withdrawn from its cyst cavity. × 20.

Fig. 9. *Colon.* Two cysts magnified to show their plastic form. × 16.

Fig. 10. *Œsophagostome.* It had ruptured the walls of its subperitoneal cyst and had penetrated the mesenteric attachment of the ileum. × 12.

C.N. Censi del. ad nat.

ŒSophagostomum stephanostomum var Thomasi

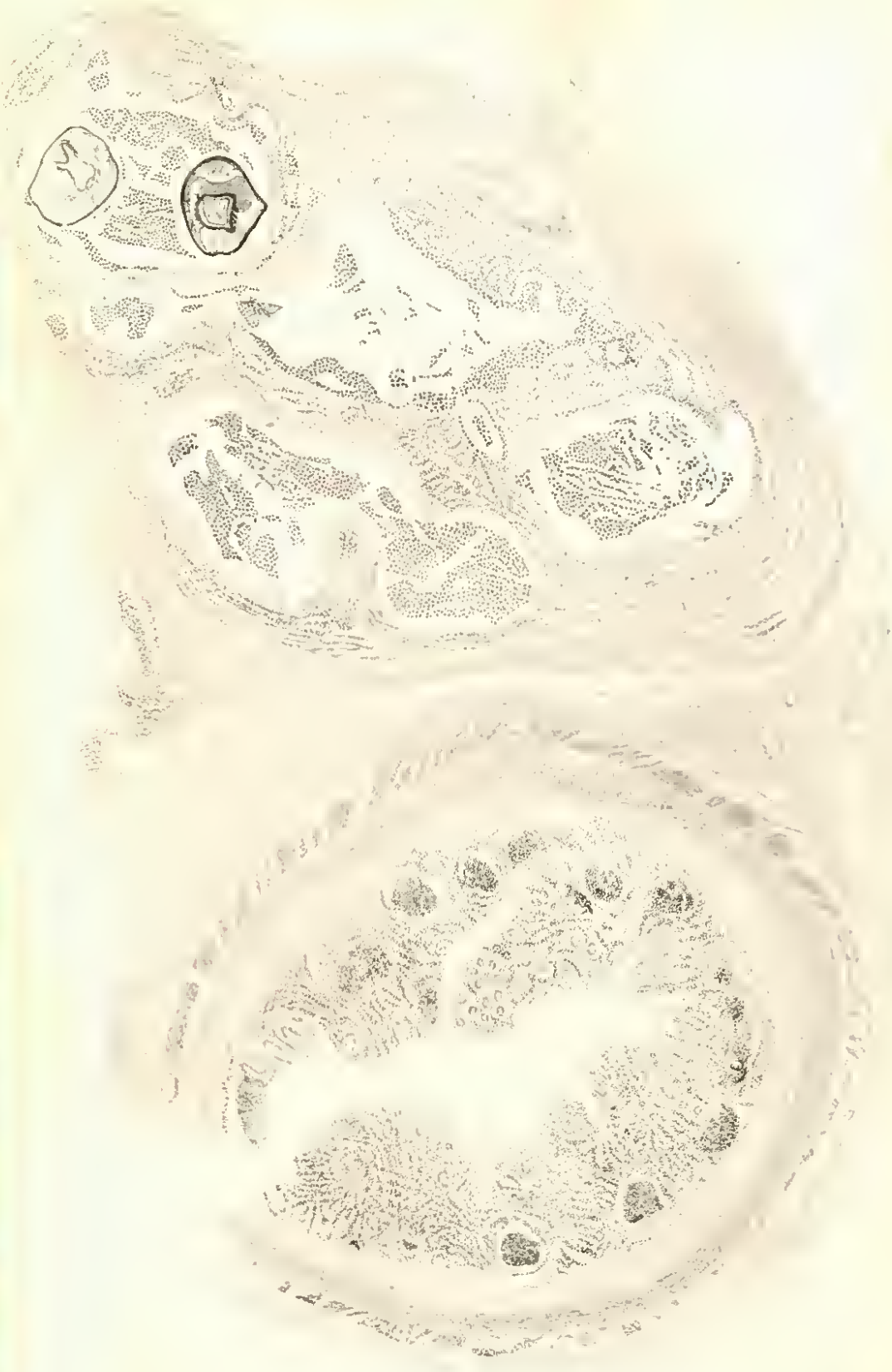
Plate V[A]

Portion of ileum showing leech-like subperitoneal cyst. Longitudinal section. In the degenerated haemorrhagic contents two sections of a worm are lying. Note the collection of leucocytes around the inside of the wall of the cyst and the leucocytic infiltration of the walls. In the internal muscular coat is a small cyst. The leucocytic infiltration is extensive and extends into the submucosa.

Press, Imp.

Plate V[B]

Subperitoneal tumour growing from the wall of the appendix vermiformis. Note the division of the tumour into two cysts and the partial sub-division of them by bands of connective tissue. The contents of cysts are chiefly pus cells. Two cross-sections of an œsophagostome are seen in the outer-cyst.



P. P. Press, Imp.